Claims:

1. A method for performing channel equalization in a receiver, in which a signal is received from a communication channel, the signal containing symbols formed of binary information by phase shift keying, channel estimation is performed to estimate the properties of the communication channel, and samples are taken of the received signal at intervals, **wherein** in the method, a determined number of samples are examined, a decision step is taken, in which, to find out the transmitted symbols, the bit decisions are computed on the basis of said defined quantity of samples, and after each decision step it is examined whether said decision step is to be iterated, wherein upon iteration of said decision step, at least some of the bit decisions of the previous decision step are used in addition to the samples under examination, in the computation of the bit decision.

2. The method according to claim 1, **wherein** for performing said decision step, a cost function is defined

$$f(B)=\frac{1}{2}\sum_{t=0}^{T}\left(\left\|r_t-\sum_{s=0}^{H-1}h_s S(B_{t-s})\right\|^2-\sum_{s=0}^{H-1}\overline{h}_s h_s \overline{S}(B_{t-s})S(B_{t-s})+\sum_{k=1}^{M}\left(b_{t,k}-\frac{1}{2}\right)^2\right),$$

in which *S(B)* is the symbol corresponding to bits B, h_s are the estimated channel coefficients, and *r* is the received signal which is sampled, and that said cost function is subjected to minimization.

3. The method according to claim 2, **wherein** in the method, to minimize said cost function, said decision step is iterated, and in which the update rule

$$b_{l,k}(j+1)=f_h\left(\sum_{t=l}^{l+H-1} re\left\{\overline{r}_t h_{t-l}\frac{\Delta S(B_l)}{\Delta b_{l,k}}\right\}-re\left\{\overline{h}_{t-l}\frac{\Delta\overline{S}(B_l)}{\Delta b_{l,k}}\sum_{q=0,t-q\neq l}^{H-1}h_q S(B_{t-q})\right\}\right),$$

is used, where $B_l=\lfloor b_{l,1},b_{l,2},\ldots,b_{l\,M}\rfloor$ is *M* bits at the moment $l=u+l\Delta u$, $S(B_l)$ is the corresponding symbol, $\frac{\Delta S\ (B_l)}{\Delta b_{l,k}}$ is a derivative with respect to *k* bits, *h* indicates the communication channel, of which *H* channel

taps are estimated, and $f_h(x)$ is a hard limit function which receives the value 1, if $x > 0$, else 0.

4. The method according to claim 1, **wherein** in the update rule, noise is added before taking said decision step.

5. A receiver comprising

- means for receiving a signal from a communication channel, the signal containing symbols formed of binary information by phase shift keying,
- a channel estimator for estimating the properties of the communication channel,
- a channel equalizer, and
- means for sampling the received signal at intervals,

wherein the channel equalizer comprises means for examining a number of samples defined at the time, decision means for computing bit decisions on the basis of said defined number of samples to find out the transmitted symbols, and examining means for estimating the need for iterating the computation of the bit decisions, wherein upon iterating said computation of bit decisions, at least some of the bit decisions of the previous decision step are arranged to be used in addition to the samples under examination at the time.

6. The receiver according to claim 5, **wherein** for computing said bit decisions, the receiver comprises means for minimizing the cost function

$$f(B) = \frac{1}{2}\sum_{t=0}^{T}\left(\left\| r_t - \sum_{s=0}^{H-1} h_s S(B_{t-s})\right\|^2 - \sum_{s=0}^{H-1}\overline{h}_s h_s \overline{S}(B_{t-s})S(B_{t-s}) + \sum_{k=1}^{M}\left(b_{t,k} - \frac{1}{2}\right)^2\right),$$

in which *S(B)* is the symbol corresponding to bits B, h_s are the estimated channel coefficients, and *r* is the received signal which is sampled.

7. The receiver according to claim 6, **wherein** the decision means comprise means for computing the update rule

$$b_{l,k}(j+1) = f_h\left(\sum_{t=l}^{l+H-1} re\left\{ \overline{r}_t h_{t-l} \frac{\Delta S(B_l)}{\Delta b_{l,k}} \right\} - re\left\{ \overline{h}_{t-l} \frac{\Delta \overline{S}(B_l)}{\Delta b_{l,k}} \sum_{q=0, t-q \neq l}^{H-1} h_q S(B_{t-q}) \right\} \right)$$

where $B_l = \lfloor b_{l,1}, b_{l,2}, ..., b_{l,M} \rfloor$ is *M* bits at the moment $l = u + l\Delta u$, $S(B_l)$ is the corresponding symbol, $\frac{\Delta S\ (B_l)}{\Delta b_{l,k}}$ is a derivative with respect to *k* bits, *h* indicates the communication channel, of which *H* channel taps are estimated, and $f_h(x)$ is a hard limit function which receives the value 1, if $x > 0$, else 0.

8. The receiver according to claim 7, comprising computing units, each of which are arranged to determine one symbol value on the basis of said defined number of samples, and the output of each computing unit is coupled to the input of at least one other computing unit, for using the symbol values defined by the computing units in the next computation of the bit decision.

9. The receiver according to claim 8, **wherein** each computing unit contains as many iteration blocks as the bit number of symbols formed in the modulation.

10. The receiver according to claim 5, **wherein** the means for examining the number of samples determined each time comprise a delay line in which the number of delays is one less than the number of symbols to be determined from said defined number of samples.

11. The receiver according to claim 5, comprising means for adding noise in the update rule before computing said bit decisions.

12. The receiver according to any of the claims 5, comprising means for setting an initial value for the bits before computing said bit decisions.

13. A channel equalizer comprising means for sampling a signal received from a communication channel at intervals, which received signal contains symbols formed of binary information by phase shift

keying, and which received signal has been subjected to channel estimation for estimating the properties of the communication channel, **wherein** the channel equalizer comprises means for examining a number of samples defined at a time, decision means for computing bit decisions on the basis of said defined number of samples to find out the transmitted symbols, and examining means for estimating the need for iterating the computation of the bit decisions, wherein upon iterating said computation of bit decisions, at least some of the bit decisions of the previous decision step are arranged to be used in addition to the samples under examination at the time.

14. A wireless communication device comprising

- means for receiving a signal from a communication channel, the signal containing symbols formed of binary information by phase shift keying,
- a channel estimator for estimating the properties of the communication channel,
- a channel equalizer, and
- means for sampling the received signal at intervals,

wherein the channel equalizer comprises means for examining a number of samples defined at the time, decision means for computing bit decisions on the basis of said defined number of samples to find out the transmitted symbols, and examining means for estimating the need for iterating the computation of the bit decisions, wherein upon iterating said computation of bit decisions, at least some of the bit decisions of the previous decision step are arranged to be used in addition to the samples under examination at the time.